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SCIENTIFIC BOOKS.

Diplodocus Marsh. Its Osteology, Taxonomy and Probable Habits, with a Restoration of the Skeleton. Memoirs of the Carnegie Museum, Vol. I., pp. 1-63, pl. I.-XIII.

The *Memoirs of the Carnegie Museum* open auspiciously with this valuable contribution by Mr. J. B. Hatcher, curator of the department of vertebrate paleontology and associate editor of the publications of the Museum. The subject is the description of two remarkable skeletons of the great sauropodous dinosaur *Diplodocus* discovered by the Museum expeditions of 1899 and 1900 on Sheep Creek, Albany County, Wyoming. The first specimen consists of forty-one vertebrae, which form an unbroken series from the second or axis vertebra to the twelfth vertebra of the tail, besides extensive parts of the appendicular skeleton, all in a remarkable

state of preservation. The fourteen cervicals alone measure 21 feet and the author estimates a total length of 68 feet for the vertebral column and skull. The second skeleton belongs to a smaller animal in which one of the hind limbs is perfectly preserved, and with the aid of a fore limb and of some characters taken from the tail of a specimen in the American Museum collection, Mr. Hatcher gives (Plate XIII.) by far the most perfect restoration of a Sauropod which has yet been published. The neck is extraordinarily long and slender, increasing in power and in the length of the centra near the chest. The back, including only eleven vertebrae with short centra is extremely short; while the long and heavy tail evidently balances the anterior portion of the column, and the sacrum forms the center of the body. The marvelously light and yet strong structure of the vertebrae is well brought out in the pen drawings by Mr. Weber, and the author adds a number of most useful new terms for the future description of these elaborate structures. Of the animal as a whole he observes:

The restoration at once reveals the unusual proportions of *Diplodocus*. The remarkable long neck and tail contrast strikingly with the short body. The hind limbs are longer than the fore limbs, and this fact, together with the enormous elevation of the spines of the sacrals and posterior dorsals, fixes the sacral region as the highest in the vertebral column, a determination first made by Osborn. The powerful ilia, firmly united to the rigidly coossified sacrals with lofty coalesced spines, together with the other pelvic elements proportionately well developed, at once emphasizes the paramount importance of the pelvic region and fixes it as the center of power and motion.

Among the new important points brought out in this Memoir are the following: First, the gradual transition from the paired spines of the neck to the highest single spines of the back; the clear description and definition of the remarkable cavities surrounding the vertebrae, intramural or inside of the bones as well as around the centra and neural arches; the modification of the first two dorsals especially for the support of the scapula; the presence of four true sacrals and of one dorso-sacral or pelvic vertebra, strengthening the support of

the ilium; the fact that the posterior sacral is larger than the anterior, showing the enormous power exerted by the tail; the coossification of the 17th and 18th caudal vertebrae, indicating that this was a fixed point when the animal stood upon its hind feet and partly supported itself upon the tail in the tripododal condition; the excessively small neural canal throughout, the probable presence of a pair of clavicles, not hitherto observed in the *Sauropoda*; the hollow character of the large limb bones.

These skeletons are referred to a new species, *D. carnegiei*, in honor of the founder of the Pittsburgh Museum.

As regards the habits of these animals Mr. Hatcher speaks as follows:

From the above consideration I am inclined toward the opinion that *Diplodocus* was essentially an aquatic animal, but quite capable of locomotion on land. Though living for the most part in the more important rivers and fresh-water lakes, it may not infrequently have left the water and taken temporarily to the land, either in quest of food or in migration from one to another of adjacent bodies of water.

It is not improbable that during the period when these huge dinosaurs lived and flourished over what is now New Mexico, Colorado, Wyoming, Montana and the Dakotas, there prevailed throughout this region physical conditions somewhat similar to those which exist to-day in tropical America and more especially over the costal plain of the lower Amazon with its numerous bayous and islands, or the more elevated valleys of the anterior in the Brazilian provinces of Amazonas and Matto Grosso with their numerous lakes and large rivers surrounded by a dense tropical vegetation with broad, level valleys subject to periodical inundations.

With the beginning of the Cretaceous there began a subsidence over this region, and a great inland sea was formed which gradually encroached upon the habitat of these animals, more and more restricting the area adapted to them, so that at about the commencement of the Upper Cretaceous the entire region formerly occupied by them had become a shallow sea save only certain islands of limited extent, and perhaps otherwise poorly adapted as the homes of such animals as were the *Sauropoda*.

A few years more of such efficient exploration as this and of such remarkably careful field and preparation work promises to give us a knowledge of the osteology of these great *Sauropods* almost as complete as our knowledge of the

skeleton of the recent horse, for example. The author of the present work and Dr. J. L. Wortman, who found the type skeleton, have led the way in these methods of field work.

HENRY F. OSBORN.

An Introduction to Physiology. By WILLIAM TOWNSEND PORTER, M.D., Associate Professor of Physiology in the Harvard Medical School. Cambridge, Mass., The University Press. Pp. 314.

This small volume contains in a convenient form what is apparently the course of practical physiology given for the past two or three years at the Harvard Medical School. To those who are not conversant with the difficulties that beset the practical teaching of the subject to large classes it may appear surprising that in this matter the large American medical schools should have lagged behind the smaller, in some of which courses of a considerably wider scope than that under review have not only, for the best part of a decade, been available for the advanced student of medicine, but have taken their place among the compulsory subjects of the ordinary curriculum. He, however, who knows how much wise planning and laborious organization—what material, intellectual and even moral resources—are required for the successful conduct of a practical class for a couple of hundred students will be much more ready to congratulate Dr. Porter and the Harvard Medical School on the satisfactory results of their efforts than to criticise them as belated laborers in the vineyard of practical physiology. Nor will the experienced teacher whose circumstances enable him to make free use of mammals as well as frogs seriously blame, however much he may regret, the entire omission of mammalian experiments, except those performed on the students themselves. He will nevertheless note that the lack of this element, so valuable, under proper conditions, in the training of the medical students, renders the book less suited to the requirements of schools of moderate size than would otherwise be the case. On the other hand, for those who are so situated that they can only use frogs, the work may be recommended as a sound guide to the performance of the fundamental experiments in the general physiology